constant, 2,700,000 gallons by measure at 25 overproof are removed each month from bond. Now, taking the mean shade temperatures for the months from November 1886 to April 1887, it appears that, owing to the contraction in these 2,700,000 gallons per month, no less a quantity than 97,268 gallons of 25 overproof or of 121,586 gallons of proof spirit for the six months would accrue in the estimation as now carried on, and the duty on this amounts to £61,000, now lost to the Revenue.

It is true that probably these shade temperatures do not exactly represent the temperatures of the warehouse, which will be more equable, but then the contents of a warehouse if they lose their heat slowly also regain it slowly, and the low temperature contracted during a long and severe winter is perpetuated for a long period throughout the year; so that in all probability the average temperature of the bonded spirit is below 51° not only during six but during nine months of the year, and assuming that the mean temperature did not exceed 47° during these extra three months, the additional loss to the Revenue would amount to £10,000.

The foregoing statements have been published for some time, and have not been confuted except in the usual official Parliamentary style. This, we urge, is insufficient. What the public wants to know, and has a right to learn, is, what, if the Revenue authorities dispute these assertions, are their grounds for so doing? Should this information not be forthcoming, the opinion will gain ground that another Government Department is trying hard "how not to do it."

PRESTWICH'S "GEOLOGY."

Geology: Chemical, Physical, and Stratigraphical. By Joseph Prestwich, M.A., F.R.S., F.G.S., Correspondent of the Institute of France, Professor of Geology in the University of Oxford. In Two Volumes. Vol. II. Stratigraphical and Physical. (Oxford: Clarendon Press, 1888.)

IT is just two years ago that we were called upon to notice the first volume of this important treatise; and the author of it has now signalized the completion of his labours at Oxford by giving to the world the second and concluding volume of the work. Its publication has long been eagerly looked forward to, and now that the book is before us, we may safely assert that it more than justifies the high expectations which have been formed concerning it; and we confidently predict that it will add to the already high reputation of the veteran geologist to whom we are indebted for it.

In reading the first chapter of the book, everyone must be struck by the fact that a distinct advance has been made in the mode of treatment of the great problems of stratigraphical geology. Speaking of the "order of succession" and "the breaks in continuity" in the series of stratified rocks, Prof. Prestwich writes:—

> "The great time-divisions are of almost universal application; but the smaller 'breaks in continuity,' which are of frequent occurrence in all areas, are subject to constant differences of extent and value; consequently, in filling up the details of the several geographical areas, each one is found to have its own local stamp, and possesses its own special terms, some knowledge of which is as essential to the geologist as is the language of a country to the traveller, if he would pass through it with profit."

The author then proceeds to show how impossible is any universal scheme of geological classification, and to discuss the question, first raised by Edward Forbes and Prof. Huxley, as to how far geological equivalence is to be regarded as being identical with actual synchronism.

He insists that, in distant areas, strata cannot be correlated by identical *species*, but only by the presence of the same characteristic *genera*, and he fully admits the effects of migration of forms of life from one region to another in causing strata of different ages to present very similar faunas or floras. Such considerations as these, the author argues, must always prevent us from regarding the series of formations as being strictly contemporaneous in distant areas, or the breaks between them as being universal ones.

Prof. Prestwich points out some of the difficulties confronting geologists, in the following suggestive passage:—

> "In Western North America the great break so conspicuous between the Cretaceous and Tertiary series does not exist, and there are passage beds having characters of the two periods in common. In a similar way the Carboniferous strata in America pass gradually into the Permian, without the unconformity which exists here. In India the Gondwána system forms a consecutive series from the base of the Permian to the top of the Jurassic strata. In New Zealand, again, no marked line can be drawn between the Cretaceous and Tertiary series, the Upper Cretaceous and Lower Eocene forming unbroken and continuous series."

He then proceeds to give not *one* table of classification for the sedimentary rocks, but *six* different ones, adapted respectively to Europe, India, North America, Australia, New Zealand, and South Africa. And having thus at the very outset shown what are the obstacles in the way of the exact correlation of distant deposits, and established a philosophical basis of classification for strata, he takes up the consideration in succession of the several great geological systems; he selects the method of beginning with the oldest, and passing upwards in the scale, candidly admitting, however, that the opposite plan is not without its merits and advantages.

The account given in successive chapters of the several formations, their typical development in this country, the groups of fossils by which they are distinguished, and their chief foreign representatives, is eminently clear and readable. This merit is the more conspicuous from the circumstance that the mass of detailed information to be selected from and arranged in writing a work on stratigraphical geology is so enormous and bewildering, that such works are very apt to suffer in their style, and to become heavy and encyclopædic in character. But Prof. Prestwich has admirably avoided this danger.

The author does not waste any time in discussing barren questions of nomenclature. In the case of the three systems of the older Palæozoic, he follows the common custom of calling the oldest "Cambrian," the second "Lower Silurian," and the third "Upper Silurian"; though pointing out in a footnote the significance of the term "Ordovician."

Very striking features in the book are the chapters in which are summed up the characteristics of the faunas

© 1888 Nature Publishing Group

and floras of the Palæozoic, the Mesozoic, and the Kainozoic divisions respectively. In these reviews of the great geological epochs, the distinctive features of their life-history are ably summarized; and the subject is made clearer by the insertion of sixteen lithographic plates, the fossils represented upon these being very judiciously selected and admirably drawn.

Most readers will look with much interest to the later chapters, in which the author deals with the Tertiary and post-Tertiary deposits, the study of which has been so greatly advanced by the author's own researches. Prof. Prestwich has in several very important points modified some of the conclusions of his classic papers upon these questions. He now accepts, with most modern geologists, the term "Oligocene" as usefully embracing the strata known as the "Fluvio-marine strata" of the Hampshire Basin, and separates them from the Eocene proper. He also points out for the first time the close connection of the so called "Lower Bagshot Sands" with the London Clay, placing them in the Lower Eocene; while the Middle and Upper Bagshots of the London Basin, and the Bracklesham and Barton series of the Hampshire Basin, constitute his Upper Eocene. This view has recently been explained and defended in a paper which the author has read before the Geological Society, and is one which we think will meet with very general acceptance. In his account of the post-Pliocene (or, as he prefers to call them, the Quaternary or Pleistocene) deposits, it will also be seen that Prof. Prestwich has so far departed from his earlier published views as to admit the probability of some of the deposits which contain relics of human handiwork belonging to a period when glacial conditions prevailed in this country.

The work concludes with three chapters of a theoretical character. In the first of these Prof. Prestwich argues against the acceptance of any views, like those of Dr. Croll, which would define the exact date of the Glacial period by reference to astronomical events. Accepting the probability that man may have lived at the period of the greatest glaciation, the author boldly proceeds to challenge the common opinion that this period of glaciation must have been separated by an enormous interval of time from the present day. He even suggests that the Glacial period may not have had a duration of more than from 15,000 to 25,000 years, and the post-Glacial period he thinks may be restricted to 10,000 or 15,000 years!

The facts which seem to have had the greatest weight in leading Prof. Prestwich to these, at first sight, startling conclusions, are those connected with the movements of the great ice-sheets in Greenland. The recent observations of Rink and Helland seem to show that the data afforded by the diminutive Alpine glaciers are utterly inapplicable to the vast masses of ice which must have flowed over extensive areas during the Glacial period. While the Alpine glaciers progress at an average rate of a foot per day, the great Greenland ice-sheet advances 35 feet per day, and the effects produced in a given time by such rapidly moving masses must be proportionately great. There will doubtless be much difference of opinion among geologists upon the important suggestions made by Prof. Prestwich; but in any future discussions of the subject it must be admitted by everyone that the data upon which all our reasoning has to be based has been profoundly modified by the remarkable observations made by the Danish Scientific Commission upon the inland ice of Greenland.

In his penultimate chapter, the author points out the grounds for the view—of which he has long been one of the ablest advocates—that the earth's solid crust is a comparatively thin one; and he indicates the lines of argument by which the objections of mathematicians and physicists to such views can best be met. While demurring to the doctrine of the permanence of continental and oceanic areas, he justly points to the great effects which must result from the flow of ice-cold water over the bottom of the great oceanic depressions.

The last chapter, on "The Primitive State of the Earth," is an attempt to link the geological history on to that arrived at by the studies of the astronomer. Due importance is justly attached to the evidence afforded by meteorites, and an excellent summary is given of Daubrée's admirable researches. But here, as the author freely admits, he is on less secure ground than in the earlier chapters of his book, and the utmost he aims at doing is to supply a working hypothesis.

Both Prof. Prestwich and the Delegates of the Oxford University Press are to be congratulated upon the manner in which the work has been got up. The printing is admirably clear, and the woodcuts, most of which are original, are of exceptional excellence. The plates, which have been very skilfully drawn on stone by Miss Gertrude Woodward, exhibit the characters of the fossils illustrated in a manner superior to what we have ever seen attempted in any geological text-book. The coloured geological map of Europe, which has been prepared under the supervision of Mr. W. Topley, is brought up to date, and is very clear and serviceable.

To the splendid work now so auspiciously completed at the termination of the author's professorial career at Oxford, we heartily wish all the success it so well deserves. J. W. J.

VACCINATION.

Cow-Pox and Vaccinal Syphilis. By C. Creighton. (London: Cassell, 1887.)

Vaccination Vindicated. By J. C. McVail. (London: Cassell, 1887.)

TWO new books have lately appeared on vaccination; one on the natural history of "Cow-Pox and Vaccinal Syphilis," by Dr. Charles Creighton; the other, "Vaccination Vindicated," by Dr. J. C. McVail.

The first mentioned, that by Dr. Creighton, is a very misleading work. The first four chapters are almost entirely devoted to a wholesale abuse of Jenner, and the fact that Jenner has called the cow-pox the "variolæ vacciniæ," is especially singled out for more than usual criticism; but the very virulence of the abuse will lead to its condemnation, and the memory of the man who deserves so well of his country will not therefore be unjustly thought of by his countrymen.

The whole burden of the rest of the book may be summed up in a passage that occurs on p. 155: "The real affinity of cow-pox is not to the small-pox but to the great-pox." Let it be remembered that these two diseases are placed together by the science of medicine

© 1888 Nature Publishing Group